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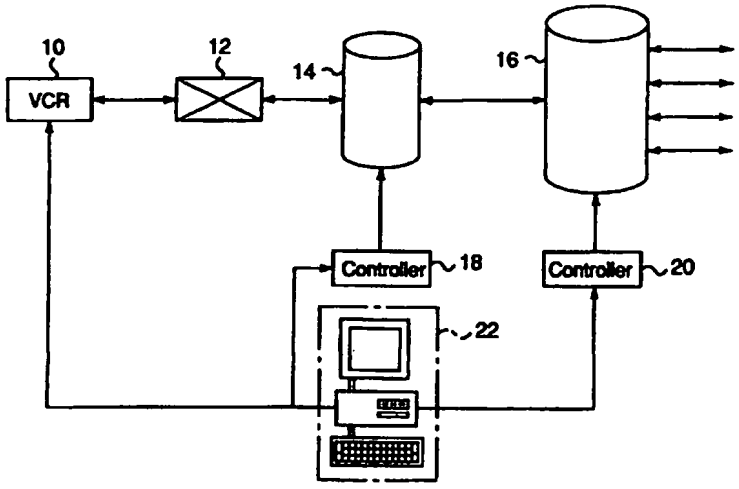

(57) Abstract

A local server (102) records compressed digital video data according to a first image compression format at normal and four times speeds, while a main server (106) records compressed digital video data according to a second image compression format at normal speed. An image format converter (104) is provided between the local and main servers (102 and 106). The image format converter (104) converts compressed digital video data according to the first image compression format output at normal speed from the local server (102) to compressed digital video data according to the second image compression format to be sent to the main server (106). The image format converter (104) also converts compressed digital video data according to the second image compression format output at normal speed from the main server (106) to compressed digital video data according to the first image compression format to be sent to the local server (102). Then, compressed digital video data can be input and output at a high speed when digital video data compressed are recorded after the image conversion format is changed and compressed digital video data are output for reproduction after the image conversion format is changed.

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DESCRIPTION

COMPRESSED VIDEO DATA PROCESSING WITH CONVERSION OF IMAGE COMPRESSION FORMAT

Technical Field

The present invention relates to a system which processes compressed video data of different compression formats and to an apparatus for recording and reproducing compressed video signals of different compression formats.

Background Art

In a television broadcasting station, digital video cassette recorders are used by reporters to gather news materials or the like. Then, records in the digital video cassette recorders are reviewed and edited for broadcasting.

The records are transferred to a server including a hard disk or the like having a high storage capacity. Once the data are stored in the server, they can be accessed by any computer connected to the server. It is desired in a television broadcasting station to broadcast latest news. Therefore, it is required to transfer the records gathered in the recorder to the server as fast as possible.

Video data without compression can be transmitted between a digital video cassette recorder and a server. On the other hand, when compressed video data are transmitted, the data can be transferred if data compression format of the digital video cassette recorder is the same as that of the main server. However, usually compression format of video data such as DV format of digital video cassette recorder is

different from that of a server such as MPEG standard. Therefore, a format converter for converting data compression format is needed between the digital video cassette recorder and the server. However, if the transfer speed of the server is normal speed, the compressed digital video data can be transferred only at the normal speed from the digital video cassette recorder. Therefore, speed cannot be increased even if the recorder can reproduces the data at a faster speed. It is desirable to construct a system which can deal video data at a fast speed even if various data compression formats are used therein.

Disclosure of the Invention

An object of the present invention is to provide a compressed video data processing system and an apparatus therefor which can satisfy compatibility of compressed digital video data of two or more different image compression formats.

Another object of the present invention is to provide a compressed video data processing system and an apparatus therefor which can record or reproduce compressed video data at a high speed even if conversion between two or more different image compression formats are processed.

In one aspect of the invention, a compressed video data processing system comprises a digital video cassette recorder for recording and reproducing video data according to a first image compression format, a first recording and reproducing device as a local server, and an image format converter connected between the digital video cassette

recorder and the first recording and reproducing device. Further, the first recording and reproducing device as a local server is connected to a second recording and reproducing device as a main server. The first and second recording and reproducing devices record and reproduce compressed digital video data according to a second image compression format different from the first image compression format. The image format converter converts compressed digital video data between the first image compression format and the second image compression format. The second recording and reproducing device may be accessed by computers through a network. By providing the first recording and reproducing device between the image format converter and the second recording and reproducing device, the second recording and reproducing device can operate normally even when accessed by many computers.

In another aspect of the invention, a compressed video data processing system comprises a digital video cassette recorder, a first recording and reproducing device as a local server connected to the digital video cassette recorder, a second recording and reproducing device as a main server, an image format converter connected between the first and second recording and reproducing device. The digital video cassette recorder and the first recording and reproducing device record and reproduce video data according to a first image compression format, while the second recording and reproducing device record and reproduce video data according

to a second image compression format. The image format converter converts compressed digital video data between the first and second image compression formats. Compressed video data are transferred between the digital video cassette recorder and the first recording and reproducing device at a first speed, while compressed digital video data are transferred in a network transmission format between the first and second recording and reproducing devices through the image format converter at a second speed. The first recording and reproducing apparatus can record and reproduce data at either of the first and second speeds. Then, even if video data of the first and second image compression formats are not compatible with each other, compressed digital video data according to the first image compression format can be converted to those according to the second one, and vice versa. Thus, video data of different compression formats can be used easily in a single system. The first speed can be determined independently of the second speed. It is preferable that the second speed is faster than the first speed in order to transfer the data in the digital video cassette recorder at a high speed in a form accessed in the first recording reproducing device.

Preferably, the image format converter may support a plurality of conversion processes between the first image compression format and one of a plurality of the second image compression formats for the main server. In the image format converter, a format detector detects the second image compres-

sion format and selects one of the conversion processes automatically according to the second image compression format detected by the image format converter. Thus, a user can use video data without knowing image compression format.

In order to support a plurality of the first image compression formats, a plurality of combinations of the first recording and reproducing device and the compression format converter are provided preferably, each of the combinations corresponding to one of the plurality of the first image compression formats. Then, compressed digital video data according to the first image compression format of two or more different speeds can be converted to each other. Preferably, the first recording and reproducing device comprises a plurality of input/output ports for compressed digital video data according to the first image compression format. Then, a plurality of compressed digital video data according to the first image compression format can be output or input efficiently. Preferably, the second recording and reproducing means comprises a plurality of input/output ports for compressed digital video data according to the second image compression format. Then, a plurality of compressed digital video data according to the second image compression format can be output or input efficiently.

Components in the system can be integrated as an apparatus. For example, a compressed video data processing apparatus comprises the digital video cassette recorder, the first recording and reproducing device and the image format

converter. In a different example, a compressed video data processing apparatus comprises the first recording and reproducing device and the image format converter. Thus, a user can deal video data easily without knowing conversion of image compression format. In these examples, the digital video cassette recorder is connected to the apparatus as an external component.

An advantage of the present invention is that the second recording and reproducing device as a main server can operate normally when video data of the first image compression format different from the image compression format thereof are recorded or reproduced after conversion of the image compression format.

Another advantage of the present invention is that video data can be transferred at a fast speed to the first recording and reproducing device.

A further advantage of the present invention is that a system can comprise components of various image compression formats.

Brief Description of the Drawings

These and other objects and features of the present invention will become clear from the following description taken in conjunction with the preferred embodiments thereof with reference to the accompanying drawings, and in which:

Fig. 1 is a block diagram of an video data processing system of a first embodiment according to the invention;

Fig. 2A is a block diagram of one part of the image format converter, and Fig. 2B is a block diagram of another part of the image format converter;

Fig. 3 is a block diagram of an video data processing system of a second embodiment according to the invention;

Fig. 4A is a block diagram of one part of the image format converter, and Fig. 4B is a block diagram of another part of the image format converter;

Fig. 5 is a block diagram of an apparatus for video data processing according to the invention;

Fig. 6 is a block diagram of a VCR/network according to an example of the apparatus shown in Fig. 5;

Fig. 7 is a block diagram of an apparatus for video data processing according to the invention; and

Fig. 8 is a block diagram of a VCR/network according to an example of the apparatus shown in Fig. 7.

Best Mode for Carrying Out the Invention

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, Fig. 1 shows an video data processing system of a first embodiment according to the invention. In the system, a digital video cassette recorder 10 is connected through an image format converter 12 as an

interface to a first recording and reproducing apparatus 14 having a large capacity storage device such as a hard disk and operating as a local server. The image format converter 12 converts a first image compression format (for example, DVCPRO as a kind of DV format), of video data of the digital video cassette recorder 10 to a second image compression format (for example, Motion-JPEG) of the first recording and reproducing apparatus 14, and vice versa. The first recording and reproducing apparatus 14 is connected through a network to a second recording and reproducing apparatus 16 having a large storage capacity device such as a hard disk and operating as a main server. Compressed video data are transmitted between the two apparatuses 14 and 16 in a network transmission format. The second recording and reproducing apparatus 16 is connected through a network to a plurality of external recording and reproducing apparatuses, and it may be accessed by a plurality of other image processors. The first recording and reproducing apparatus 14 is controlled by a first controller 18, while the second recording and reproducing apparatus 16 is controlled by a second controller 20. A main controller 22 comprising a personal computer, a monitor, a keyboard and the like controls the digital video cassette tape recorder 10 and the first and second controllers 18 and 20 in the total system by using control signals sent in serial transmission of RS 422A standard or the like. The controllers 18, 20 and 22 are known to a person skilled in the art, and they are not explained here further.

In the video data processing system shown in Fig. 1, digital video data of a moving picture of the first image compression format (for example, DVCPRO) are recorded and reproduced by the digital video cassette recorder 10 at normal speed. The image format converter 12 converts the receive video data to video data according to the second image format without compression at normal speed. Then, the first recording and reproducing apparatus 14 as a local server stores the video data according to the second image format. It can edit video data of the moving picture. Then, the video data are transferred to the second recording and reproducing apparatus 16 as a main server, so that the video data can be accessed by other computers through the network. The two recording and reproducing apparatus 14 and 16 can process video data of the same image compression format.

In this system, when video data recorded in the digital video cassette recorder 10 is transferred to the recording and reproducing apparatus 14, it is needed that the video data has to be processed at the normal speed for converting the image compression format. Because the first recording and reproducing apparatus 14 as the local server is provided between the digital video cassette recorder 10 and the second recording and reproducing apparatus 16 as the main server, the main server operates normally even when it is accessed by many computers connected to the main server. Then, the video data can be transmitted normally to and from the digital video cassette recorder 10.

Next, the components 10 - 22 in the image processing system shown in Fig. 1 are explained. The digital video cassette recorder 10 records compressed digital video data of the first data compression format such as DVCPRO standard in a digital video cassette and reproduces compressed digital video data recorded in a digital video cassette with the first image compression format at normal speed.

The image format converter 12 receives compressed digital video data of the first image compression format reproduced at normal speed received from the digital video cassette recorder 10 and converts them to digital component serial data of SMPTE 259M standard without compression. On the other hand, it converts digital component serial data of SMPTE 259M standard without compression to compressed digital video data of the first image compression format. Details of the image format converter 12 will be explained later with reference to Figs. 2A and 2B.

The first recording and reproducing apparatus 14 includes a large capacity storage device such as a hard disk drive and operates as a local server. The apparatus 14 converts digital component serial data of SMPTE 259M standard received from the image format converter 12 to video data of a second image compression format such as Motion-JPEG and stores them. It can edit the stored data. Further, the compressed digital video data according to the second image compression format is sent to the second recording and reproducing apparatus 16 in a network transmission format such

as ATM format or SDDI format. On the other hand, it can store compressed digital video data according to the second image compression format received from the second recording and reproducing apparatus 16 in the network transmission format. It reproduces video data as digital component serial data according to SMPTE 259M standard and sends them to the image format converter 12.

The second recording and reproducing apparatus 16 includes a large capacity storage device such as a hard disk drive and operates as a main server. The apparatus 14 stores as-received digital video data compressed according to the second image compression format received in the network transmission format from the first recording and reproducing apparatus 14. It also transmits the digital video data of the second image compression format through the network to other recording and reproducing apparatuses operating as main or local servers. When compressed digital video data stored in the recording and reproducing apparatus 16 are used, a processing reverse to the above-mentioned one is carried out.

The image format converter 12 will be explained here. Fig. 2A shows an example of one part of the image format converter 12 for converting compressed digital video data of the first image compression format to digital component serial signals of SMPTE 259M standard. A digital data expansion circuit 30 expands compressed digital video data to non-compressed data. A first converter 32 converts the non-compressed data to digital composite signals. A

second converter 34 converts the digital composite signals to 4:2:2 component signals. A third converter 36 converts the 4:2:2 component signals to digital component serial data of SMPTE 259M standard. In a modified example, the first converter 32 converts the non-compressed data to 4:1:1 component signals, and the second converter 34 converts the 4:1:1 component signals to 4:2:2 ones.

Fig. 2B shows an example of another part of the image format converter 12 for converting digital component serial signals of SMPTE 259M standard to compressed digital video data of the first image compression format. A fourth converter 40 converts digital component serial data of SMPTE 259M standard to 4:2:2 component signals. A fifth converter 42 converts the 4:2:2 component signals to digital composite signals. A sixth converter 44 converts the digital composite signals to video data. A digital data compression circuit 46 compresses the video data to compressed digital data. In a modified example, the fifth converter 42 converts the 4:2:2 component signals to 4:1:1 component signals, and the sixth converter 44 converts the 4:1:1 component signals to video data.

One problem of the above-mentioned video data processing system of the first embodiment is that transfer speed of video data from the digital video cassette recorder 10 to the first recording and recording apparatus 14 cannot be increased because image compression format has to be converted by the converter 12. The conversion of image compression

format is needed because video data in the video cassette recorder 10 cannot ba accessed by a computer or a server until the data compression format thereof is converted to the second data compression format. In the conversion, the transfer speeds of the compressed digital video data of the different image compression formats have to be kept the same. Therefore, if the transfer speed of the recording and reproducing apparatus 16 is normal speed, the compressed digital video data can be transferred only at normal speed. Therefore, the speed cannot be increased. Then, it is desirable to provide an video data processing system where video data can be transmitted fast between a digital video cassette recorder and a recording and reproducing apparatus processing the video data. Another problem of the system is that video data is deteriorated at the conversion of image compression format before they are edited in the first recording and reproducing apparatus 14.

Fig. 3 shows a block diagram of an video data processing system of a second embodiment according to the invention which solve the above-mentioned problems. In contrast to the system of the first embodiment shown in Fig. 1, positions of a first recording and reproducing apparatus 102 and an image format converter 104 are different from the counterparts of the first embodiment. In the system shown in Fig. 3, a digital video cassette recorder 100 is connected to a first recording and reproducing apparatus 102 having a large capacity storage device such as a hard disk and operating as

a local server. The first recording and reproducing apparatus 102 is connected through an image format converter 104 as an interface to a second recording and reproducing apparatus 106 having a large storage capacity device such as a hard disk and operating as a main server. The image format converter 104 converts video data format, a first image compression format (for example, Motion-JPEG), of video data in the first recording and reproducing apparatus 102 to a second image compression format (for example, DVCPRO). The second recording and reproducing apparatus 106 is connected through a network to a plurality of recording and reproducing apparatuses. Thus, the second recording and reproducing apparatus 106 may be accessed by a plurality of other computers. The first recording and reproducing apparatus 102 is controlled by a first controller 108, while the second recording and reproducing apparatus 106 is controlled by a second controller 110. A main controller 112 comprising a personal computer, a monitor, a keyboard and the like controls the digital video cassette tape recorder 100 and the first and second controllers 108 and 110 with control signals sent in serial transmission according to RS 422A standard. The controllers 108, 110 and 112 are known to a person skilled in the art, and they are not explained here further.

In the system explained above, video data of two or more different image compression formats are recorded and reproduced independently of transfer speed. The image transfer can be performed in two directions. For example, a

user can transfer video data in a digital video cassette at four times speed in the system as if he or she operates a single recording and reproducing apparatus having a large capacity storage device of a single image compression format.

Next, the components 100 - 106 in the image processing system shown in Fig. 3 are explained. The digital video cassette recorder 100 records and reproduces compressed digital video data of a first image compression format (for example, DVCPRO) at four times speed. The recorder 100 records compressed digital video data of the first data compression format in a digital video cassette and reproduces compressed digital video data recorded in a digital video cassette with the first image compression format.

The first recording and reproducing apparatus 102 has a large capacity storage device such as a hard disk drive and it operates as a local server. The large capacity storage device is not limited to a hard disk drive. For example, it may comprise a semiconductor memory having a large capacity. The apparatus 102 is connected between the digital video cassette recorder 100 and an image format converter 104 and it is controlled by a first controller 108. The apparatus 102 can be operated at a plurality of speeds and it has a function of converting speed. It receives compressed digital video data according to the first image compression format by the digital video cassette recorder 100 at four times speed therefrom and records them in the large capacity storage device. It reproduces compressed digital video data according

to the first image compression format recorded in the large capacity storage device at normal speed. It can also reproduce compressed digital video data according to the first image compression format recorded in the large capacity storage device at four times speed and transmits them to the digital video cassette recorder 100. The first recording and reproducing apparatus 102 also has a function of editing compressed digital video data of the first image compression format. In contrast to the system shown in Fig. 1, video data to be edited are not deteriorated because edition is performed before the conversion of image compression format.

In this example, recording and reproducing speeds are normal speed and four times speed. However, a various combination is possible such as normal speed and normal speed, four times speed and two times speed, two times speed and normal speed, six times speed and normal speed.

The image format converter 104 is connected between the first large capacity recording and reproducing apparatus 102 and the second large capacity recording and reproducing apparatus 106 for converting digital image format. It receives compressed digital video data of the first image compression format from the large capacity recording and reproducing apparatus 102 and converts the digital compression format thereof to a second image compression format such as Motion-JPEG at normal speed. Further, it sends the digital image of the second image compression format to the second recording and reproducing apparatus 106 in a network transmis-

sion format such as asynchronous transfer mode (ATM) or SDDI format. On the other hand, it receives digital video data of the second image compression format from the second recording and reproducing apparatus 106 in a network transmission format and converts them to video data of the first image compression format to be sent to the first recording and reproducing apparatus 102. The image format converter 104 will be explained in detail later with reference to Figs. 4A and 4B.

The second recording and reproducing apparatus 106 has a large capacity storage device such as a hard disk and it operates as a main server. The large capacity storage device is not limited to a hard disk drive. For example, it may comprise a semiconductor memory having a large capacity. The apparatus 106 is connected to the image format converter 104, and it stores as-received digital video data compressed according to the second image compression format in a network transmission format received from the image format converter 104. On the other hand, it communicates through a network to other large capacity recording and reproducing apparatuses operating as main or local servers. It is controlled by the second controller 110. It also transmits the digital video data of the second image compression format to other large capacity recording and reproducing apparatuses operating as main or local servers. It also sends compressed digital video data of the second image compression format through the converter 104 to the first one 102 in a network transmission format.

The image format converter 104 will be explained here further. Fig. 4A shows an example of a part of the image format converter 104 for converting compressed digital video data of the first image compression format such as DVCPRO to those of the second image compression format such as Motion-JPEG standard. A digital data expansion circuit 130 expands compressed digital video data to non-compressed data. A first converter 132 converts the non-compressed data to digital composite signals. A second converter 134 converts the digital composite signals to 4:2:2 component signals. A third converter 136 converts the 4:2:2 component signals to digital compression data of Motion-JPEG standard. In a modified example, the first converter 132 converts the non-compressed data to 4:1:1 component signals, and the second converter 134 converts the 4:1:1 component signals to 4:2:2 ones.

Fig. 4B shows an example of another part of the image format converter 104 for converting compressed digital video data of the second image compression format to compressed digital video data of the first image compression format. A fourth converter 140 converts compressed digital data to 4:2:2 component signals. A fifth converter 142 converts the 4:2:2 component signals reversely to digital composite signals. A sixth converter 144 converts the digital composite signals to video data. A digital data compression circuit 146 compresses the video data to compressed digital data of the first image compression format. In a modified example, the fifth converter 142 converts the 4:2:2 component

signals to 4:1:1 component signals, and the sixth converter 144 converts the 4:1:1 component signals to video data.

Operation in this system is explained. When a moving picture as compressed digital video data is transferred to the recording and reproducing apparatus 106 as the main server, compressed digital video data recorded in a digital video cassette according to the first image compression format (DVCPRO) are reproduced by the digital video cassette recorder 100 at four times speed and recorded in the recording and reproducing apparatus 102 as the local server. It is a feature of this system that moving pictures recorded in a digital video cassette can be sent to the hard disk in the recording and reproducing apparatus 102 at a speed much faster than the normal speed used in the system shown in Fig. 1. If necessary, the picture data are edited by the recording and reproducing apparatus 102.

When the data stored in the first recording and reproducing apparatus 102 are transferred to the second recording and reproducing apparatus 106, the apparatus 102 reproduces the compressed digital video data according to the first image compression format at the normal speed different from the four times normal speed at the recorder 100, and the image format converter 104 as an interface converts them to compressed digital video data according to the second image compression format (Motion-JPEG) at the normal speed and sends them to the recording and reproducing apparatus 106 in a network transfer format. Thus, the apparatus 106 stores the

compressed digital video data according to the second image compression format. Thus, the compressed digital video data according to the first image compression format received at four times speed are converted to those according to the second image compression format recorded at normal speed.

On the other hand, when compressed digital video data stored in the second recording and reproducing apparatus 106 is transferred, data flow is reversed. Compressed digital video data stored in the second recording and reproducing apparatus 106 is reproduced at normal speed to be sent to the image format converter 104 as an interface. The image format converter 104 converts them to compressed digital video data according to the first image compression format (DVCPRO) at the normal speed and sends them to the first recording and reproducing apparatus 102 to be stored at the normal speed. Then, the first recording and reproducing apparatus 102 stores compressed digital video data according to the first image compression format at four times speed to be transferred to the digital video cassette recorder 100. Thus, the recorder 100 records them at four times speed. Thus, the compressed digital video data according to the second image compression format reproduced at normal speed are converted to those according to the first image compression format to be sent at four times speed.

In the above-mentioned system, compressed digital signals from a recording apparatus such as a digital video cassette recorder can be received directly at the local

server. Then, picture data in a digital video cassette recorder can be stored at a fast speed in the local server.

When compressed digital video data to be reproduced are converted and output, the speed of the output digital video data is determined independently of the speed of the compressed digital video data when they are reproduced. Then, when compressed digital video data are converted and stored, the speed of the receive digital video data is determined independently of the speed of the compressed digital video data when they are stored. Therefore, compressed digital video data can be input at a high speed. When compressed digital video data are converted and output, the transfer speed of the digital video data to be reproduced is determined independently of the transfer speed of the compressed digital video data when they are reproduced. Therefore, compressed digital video data can be output at a high speed.

By using the image format converter 104, compressed digital video data according to the first data compression format and those according to the second data compression format having different transfer speeds can be converted to each other. Then, a single system for recording and reproducing compressed digital video data can deal two kinds of compressed digital video data according to the first and second data compression formats though the video cassette recorder and the main server use video data of different image compression formats. Therefore, a system can be constructed

without problems even if components of different compression formats are included. Further, a cost of a system is decreased where video data processors are provided for each image compression format.

In the above-mentioned embodiments, the first image compression format is DVCPRO, but it may be other image compression format used in a digital video cassette recorder and the like. The second image compression format is Motion-JPEG, but it may be MPEG2 format.

Further, in the above-mentioned embodiment, N times speed of the video data according to the first image compression format is four times speed (N = 4), while M times speed that of the video data according to the second image compression format is normal speed (M = 1). However, various combinations of the two speeds can be adopted. For example, N = 1, and M = 1. However, in order to transfer the picture images in a digital video cassette recorder 100 to the first recording and reproducing apparatus 102 at a fast speed, it is preferable that $N \geq M$, or $N \geq 2$ and $M \geq 1$.

Further, the digital video cassette recorder 100 may be integrated with the first recording and reproducing apparatus (local server) 102. Fig. 5 shows an example of an equipment 300 wherein a digital video cassette recorder (VCR) 100, a first recording and reproducing apparatus 102 with a controller 108 thereof, and an image format converter 104 are integrated. This equipment is connected to the second recording and reproducing apparatus 106 as a main server. The

apparatus 102 operating as a local server has a large capacity storage device such as a hard disk drive. Because the video cassette recorder 100 is integrated with the first recording and reproducing apparatus 102, a user can process picture video data in a digital cassette without knowing the plurality of image compression formats.

The first recording and reproducing apparatus 102 may have a plurality of input and output portions, and a plurality of digital video cassette recorders 100 may be connected thereto, as shown in Fig. 5. In such a system, one of them can transfer compressed digital video data selectively to the first recording and reproducing apparatus 102. Dubbing may be performed between two of the plurality of digital video cassette recorders 100 through the first recording and reproducing apparatus 102. Because a plurality of digital video cassette recorder 100 are integrated with the first recording and reproducing apparatus 102, input and output of video signals can be performed efficiently for compressed digital video data according to a plurality of the first image compression formats. Thus, in a single video data processing apparatus, a user can process compressed digital video data according to the first and second image compression formats without knowing the difference in image compression format. Therefore, a disadvantage caused by a necessity of using a plurality of non-compatible image compression formats can be solved.

The second recording and reproducing apparatus 106 may have a plurality of input/output ports. Then, compressed digital video data can be input and output efficiently according to the second image compression formats.

Further, a plurality of the equipments 300 may be connected to the second recording and reproducing apparatus (main server) 106, as shown in Fig. 5. In this case, each equipment 300 may correspond to a different image compression format. Then, dubbing can be performed between the plurality of digital video cassette recorder 100 having different image compression formats and different speeds.

Fig. 6 shows an example of the equipment 300. A digital video cassette recorder (VCR) 302 records and reproduces compressed video signals. An audio-visual interface 304 sends output signals of the digital video cassette recorder 302 to an internal bus 306. A hard disk interface 308 records input signals in the internal bus 306 to a hard disk 310 and reproduces output signals from the hard disk 310. A converter 312 converts input and output signals in the internal bus 306 to compression format of a main server 360. A control terminal 314 receives a control signal from a detector 316 which detects compression format in order to change compression format in the converter 312. The detector 316 analyzes signals from a network interface 318 to determine compression format of the main server 360 and sends a control signal to the control terminal 314. The network interface 318 interfaces input and output signals to and from the converter

312 to a network 340. Signals are transferred through the network to and from the main server 360. For example, if the digital video cassette recorder 302 comprises a digital video cassette recorder for a consumer use (DV format) and the compression format of the main server 360 is MPEG, the detector 316 checks compression format of the main server 360 in a communication through the network and controls the converter according to the result. If the compression format of the main server 360 is checked to be MPEG, the compressed data in the digital video cassette recorder 302 are converted to data of MPEG to be recorded in the main server 360. If the main server 360 comprises an MPEG system, ID signals are superposed in bit streams of MPEG. The detector 316 detects the ID signals and controls the control terminal 314 according to the result. Then, the converter 312 converts compressed signals of digital video cassette recorder 302 of DV format to compressed signals of MPEG. Similar operation is performed if the compression format of the main server 360 is JPEG. Thus, signals can be interfaced with no problem even if the compression format of the recording and reproducing apparatus 310 is different from that of the main server 360.

Fig. 7 shows an example of another type of an equipment 400 wherein a first recording and reproducing apparatus 102 as a local server with a controller 108 thereof, and a converter 104 are integrated. The apparatus 102 operating as a local server has a large capacity storage device such as a hard disk drive This equipment 400 is

connected between an external digital video cassette recorder 100 and the second recording and reproducing apparatus 106 as a main server.

Fig. 8 shows an example of the equipment 400. An external digital video cassette recorder (VCR) 402 for recording and reproducing compressed video signals is provided outside the equipment 400. Video signals are input and output through an audiovisual interface 404 to another audiovisual interface 406 provided in the equipment 400. The interface 406 sends output signals of the digital video cassette recorder 402 to an internal bus 408 in the equipment 400. A hard disk interface 410 records input signals in the internal bus 408 to a hard disk 412 and reproduces output signals from the hard disk 412. A converter 414 converts image compression format of signals in the internal bus 408 to that of the main server (second recording and reproducing apparatus) 460 having a large capacity storage device such as a hard disk. A network interface 418 interfaces input and output signals to and from the converter 414 to a network 440. Signals are transferred through the network 440 to and from the main server 460. For example, if the digital video cassette recorder 402 comprises a digital VCR for a consumer use (DV format) and the compression format of the main server 460 is JPEG or MPEG, the compressed data in the VCR 402 are converted to data of JPEG or MPEG to be recorded in the main server 460. Other equipment than a digital video cassette recorder may also be connected if the audiovisual interface 406 supports,

for example, SCSI interface, IEEE 1394, fiber channel or the like. Thus, video signals can be interfaced with no problem even if the compression format of the data in the hard disk 412 is different from that of the main server 460.

Though compression formats used in the above-mentioned embodiments are a format for a digital video cassette recorder (DV format) and JPEG/MPEG for computer use, other compression formats can also be used similarly such as DVCPRO format of digital video cassette recorder for professional use, or fractal or wavelet format.

Although the present invention has been fully described in connection with the preferred embodiments thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications are apparent to those skilled in the art. Such changes and modifications are to be understood as included within the scope of the present invention as defined by the appended claims unless they depart therefrom.

CLAIMS

1. A compressed video data processing system comprising:

a digital video cassette recorder for recording and reproducing video data according to a first image compression format;

a first recording and reproducing device, including a storage device, for recording and reproducing compressed digital video data according to a second image compression format different from the first image compression format;

an image format converter, connected between said digital video cassette recorder and said first recording and reproducing device, for conversion of compressed digital video data between the first image compression format of said digital video cassette recorder and the second image compression format of said first recording and reproducing device; and

a second recording and reproducing device, including a storage device and connected to said first recording and reproducing device, for recording and reproducing compressed digital video data according to the second image compression format;

wherein compressed video data are transferred between said digital video cassette recorder and said first recording and reproducing device through said image format converter at a first speed, and compressed digital video data

are transferred between said first and second recording and reproducing devices at a second speed.

2. The system according to Claim 1, wherein said first and second recording and reproducing devices transfer compressed digital video data according to the second image compression format between them in a network transmission format, and said second recording and reproducing device stores compressed video data in the network transmission format.

3. A compressed video data processing system comprising:

a digital video cassette recorder for recording and reproducing video data according to a first image compression format;

a first recording and reproducing device, including a storage device and connected to said digital video cassette recorder, for recording and reproducing compressed digital video data according to the first image compression format;

a second recording and reproducing device, including a storage device, for recording and reproducing compressed digital video data according to a second image compression format different from the first image compression format; and

an image format converter, connected between said first and second recording and reproducing devices, for converting compressed digital video data between the first

image compression format of said first recording and reproducing device and the second image compression format of said second recording and reproducing device;

wherein compressed video data are transferred between said digital video cassette recorder and said first recording and reproducing device at a first speed, and compressed digital video data are transferred between said first and second recording and reproducing devices through said image format converter at a second speed.

4. The system according to Claim 3, wherein the first speed is faster than the second speed.

5. The system according to Claim 3, wherein said first and second recording and reproducing devices transfer compressed digital video data according to the second image compression format between them through said image format converter in a network transmission format, and said second recording and reproducing device stores compressed video data in the network transmission format.

6. The system according to claim 3, wherein said image format converter supports a plurality of conversion processes between the first image compression format and one of a plurality of the second image compression formats, said image format converter comprises a format detector for detecting the second image compression format of said second recording and reproducing device and selects one of the conversion processes according to the second image compression format detected by said image format converter.

7. The system according to claim 3, wherein said first recording and reproducing device comprises a plurality of input/output ports for connecting a plurality of the digital video cassette recorder.

8. The system according to claim 3, wherein said second recording and reproducing device comprises a plurality of input/output terminals for connecting a plurality of said image format converter connected to said first recording and reproducing device.

9. A compressed video data processing apparatus comprising:

a digital video cassette recorder for recording and reproducing video data according to a first image compression format;

a recording and reproducing device, including a storage device and connected to said digital video cassette recorder, for recording and reproducing compressed digital video data according to the first image compression format; and

an image format converter, connected between said recording and reproducing device and an external recording and reproducing device, for converting compressed digital video data between the first image compression format of said recording and reproducing device and a second image compression format of the external recording and reproducing device different from that of the first image compression format.

10. The apparatus according to Claim 9, wherein the first speed is faster than the second speed.

11. The apparatus according to Claim 9, wherein said recording and reproducing device transfers compressed digital video data to and from the external recording and reproducing device according to the second image compression format through said image format converter in a network transmission format.

12. The apparatus according to claim 9, wherein said image format converter supports a plurality of conversion processes between the first image compression format and one of a plurality of the second image compression formats, said image format converter comprises a format detector for detecting the second image compression format of the external second recording and reproducing device and selects one of the conversion processes according to the second image compression format detected by said image format converter.

13. The apparatus according to claim 9, wherein said recording and reproducing device comprises a plurality of input/output ports for connecting a plurality of the digital video cassette recorder.

14. A compressed video data processing apparatus comprising:

a first recording and reproducing device, including a storage device and connected to an external digital video cassette recorder, for recording and reproducing

compressed digital video data according to a first image compression format; and

an image format converter, connected between said first recording and reproducing device and an external recording and reproducing device, for converting compressed digital video data between the first image compression format of said first recording and reproducing device and a second image compression format of the external recording and reproducing device different from that of the first image compression format.

15. The apparatus according to Claim 14, wherein the first speed is faster than the second speed.

16. The apparatus according to Claim 14, wherein said recording and reproducing device transfer compressed digital video data with the external recording and reproducing device according to the second image compression format through said image format converter in a network transmission format.

17. The apparatus according to claim 14, wherein said image format converter supports a plurality of conversion processes between the first image compression format and one of a plurality of the second image compression formats, said image format converter comprises a format detector for detecting the second image compression format of the external second recording and reproducing device and selects one of the conversion processes according to the second image compression format detected by said image format converter.

18. The apparatus according to claim 14, wherein said recording and reproducing device comprises a plurality of input/output ports for connecting a plurality of the digital video cassette recorder.

19. A method for converting compressed digital video data comprising the steps of:

recording compressed digital video data according to a first image compression format at a first speed;

reproducing the compressed digital video data at a second speed determined independently of the first speed;

converting the compressed digital video data according to the first image compression format to compressed digital video data according to a second image compression format; and

recording the digital video data according to the second image compression format at the second speed.

20. The method according to Claim 19, wherein the first speed is faster than the second speed.

21. A method for converting compressed digital video data comprising the steps of:

reproducing digital video data according to a second image compression format at a second speed;

converting the compressed digital video data according to the second image compression format to compressed digital video data according to a first image compression format;

recording the compressed digital video data according to the first image compression format at the second speed; and

reproducing the compressed digital video data according to the second image compression format at a first speed determined independently of the second speed.

22. The method according to Claim 21, wherein the first speed is faster than the second speed.

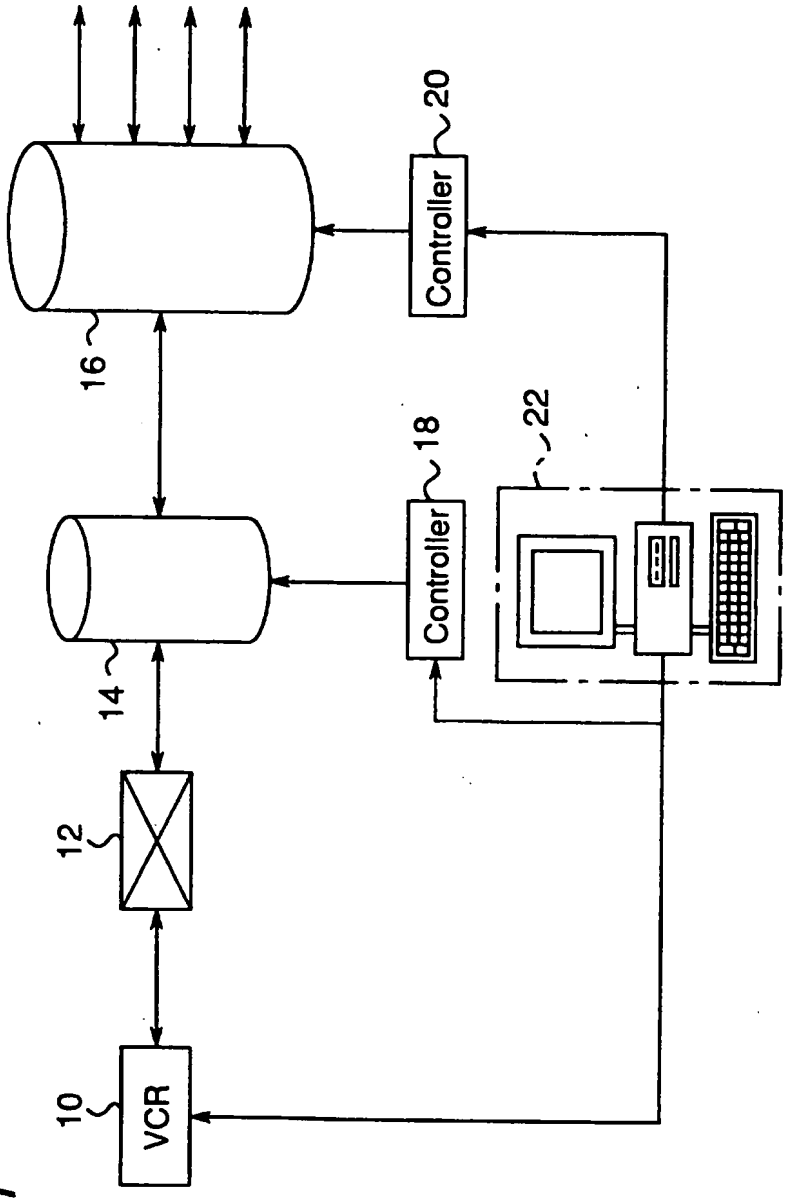


Fig. 1

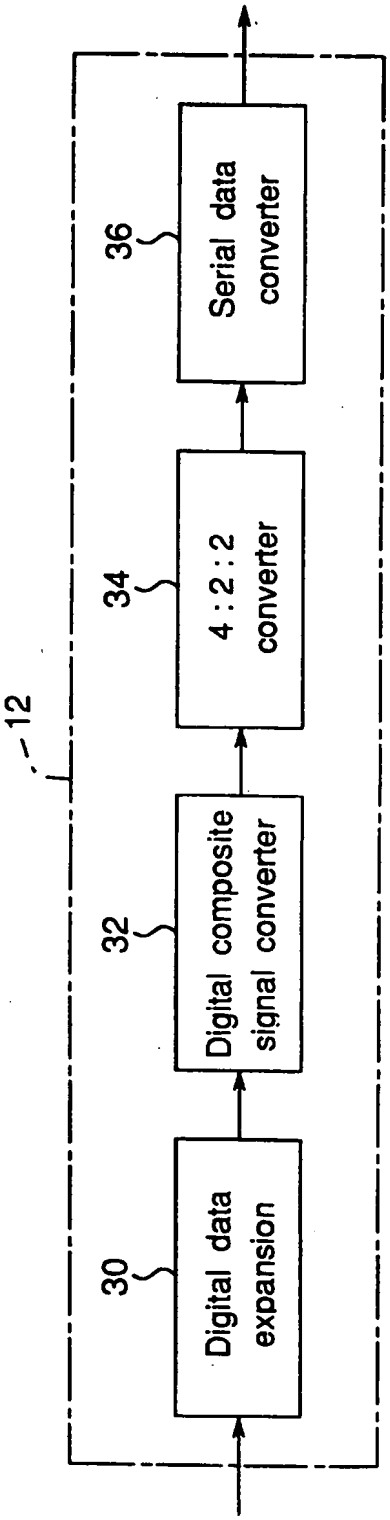
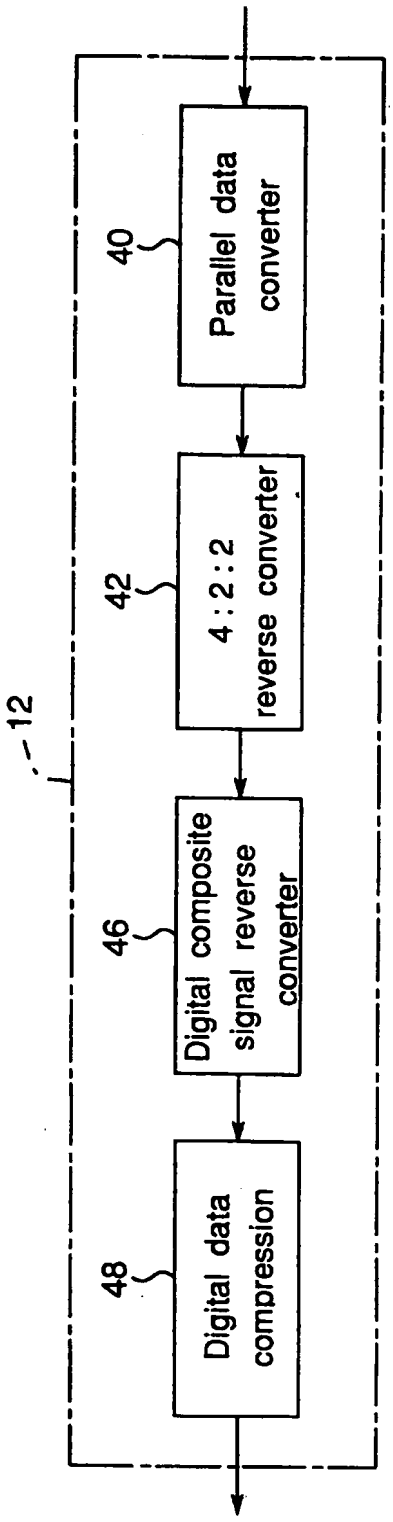

12
30
Digital data expansion
32
Digital composite signal converter
34
4 : 2 : 2 converter
36
Serial data converter

Fig.2A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40
Parallel data converter
42
4 : 2 : 2 reverse converter
46
Digital composite signal reverse converter
48
Digital data compression

Fig.2B

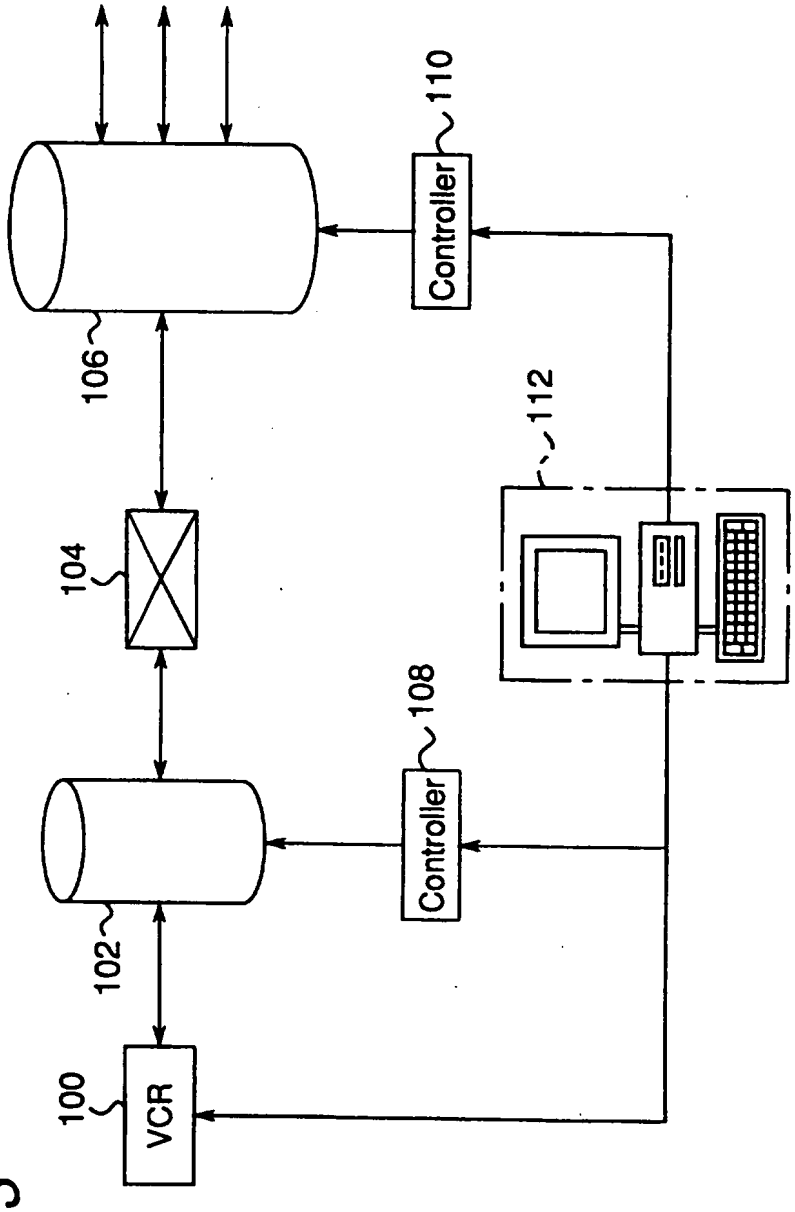


Fig.3

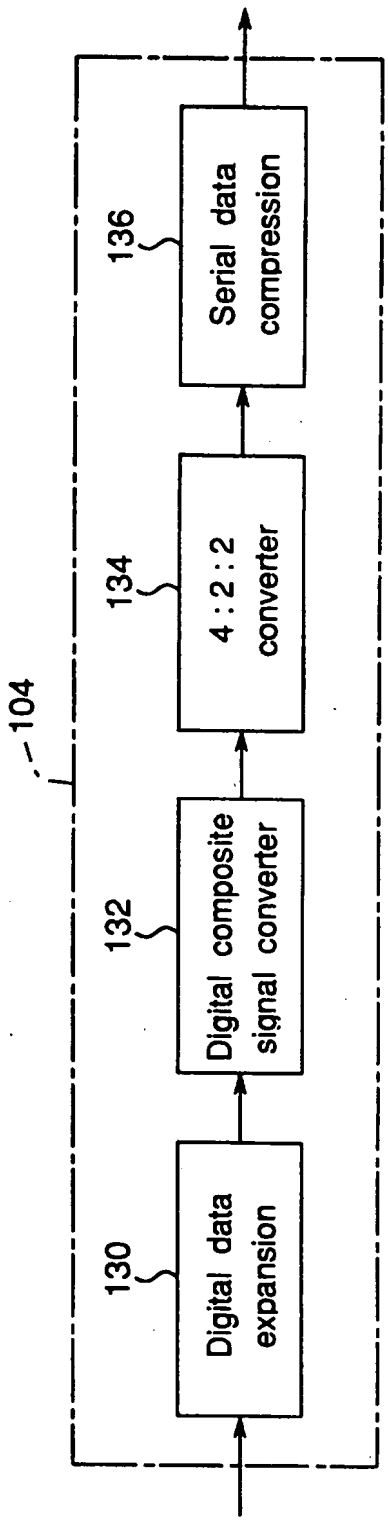

104
130
Digital data expansion
132
Digital composite signal converter
134
4 : 2 : 2 converter
136
Serial data compression

Fig. 4A

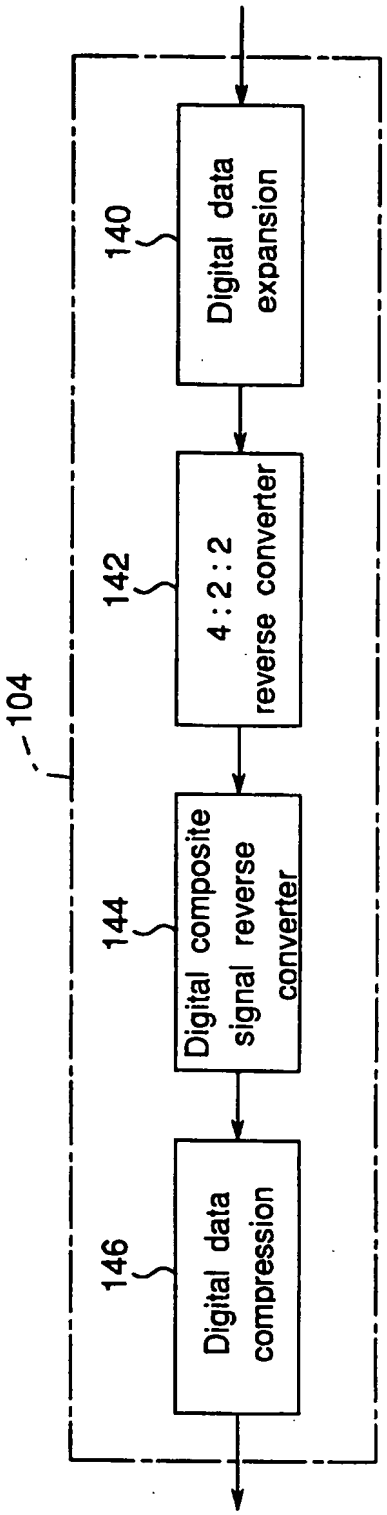

104
140
Digital data expansion
142
4:2:2 reverse converter
144
Digital composite signal reverse converter
146
Digital data compression

Fig. 4B

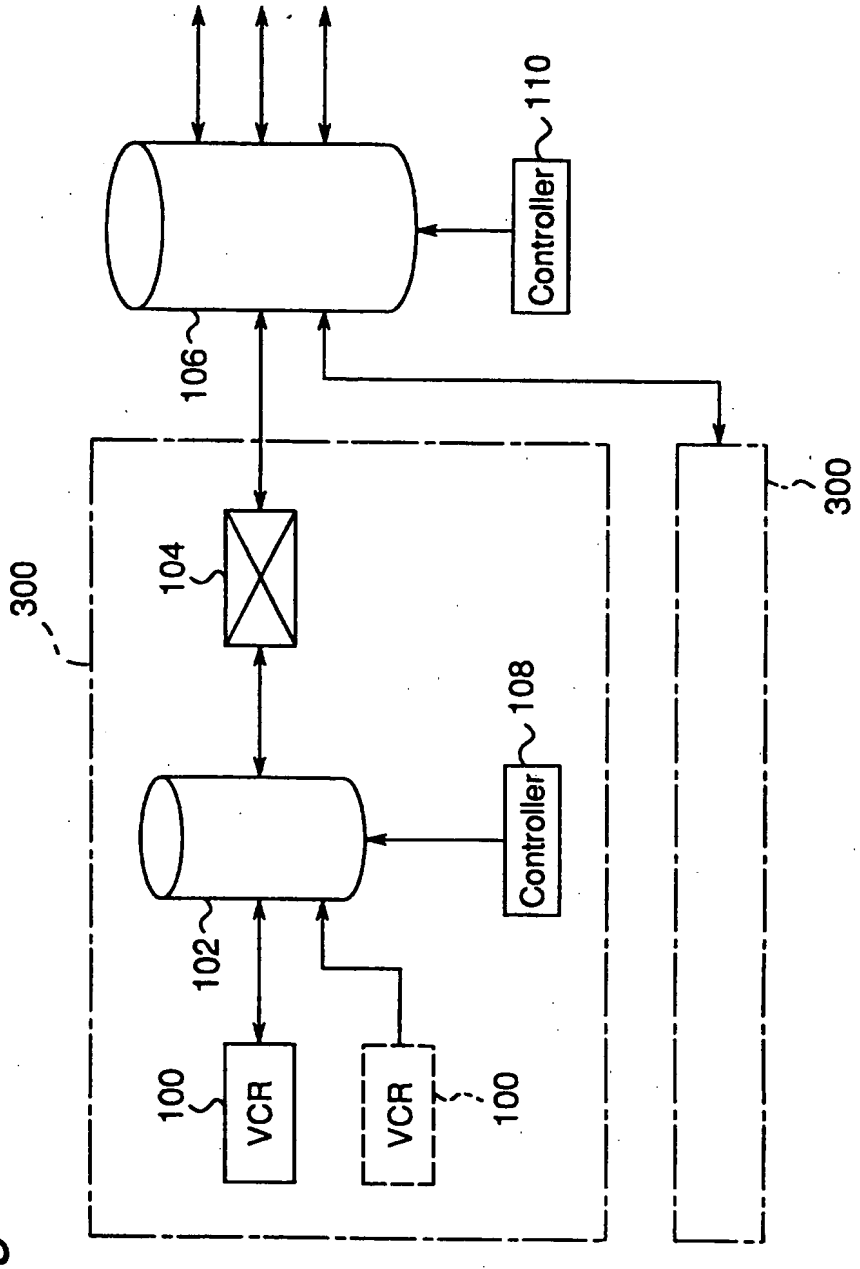

110
Controller
106
300
104
300
108
Controller
102
100
VCR
VCR
100

Fig.5

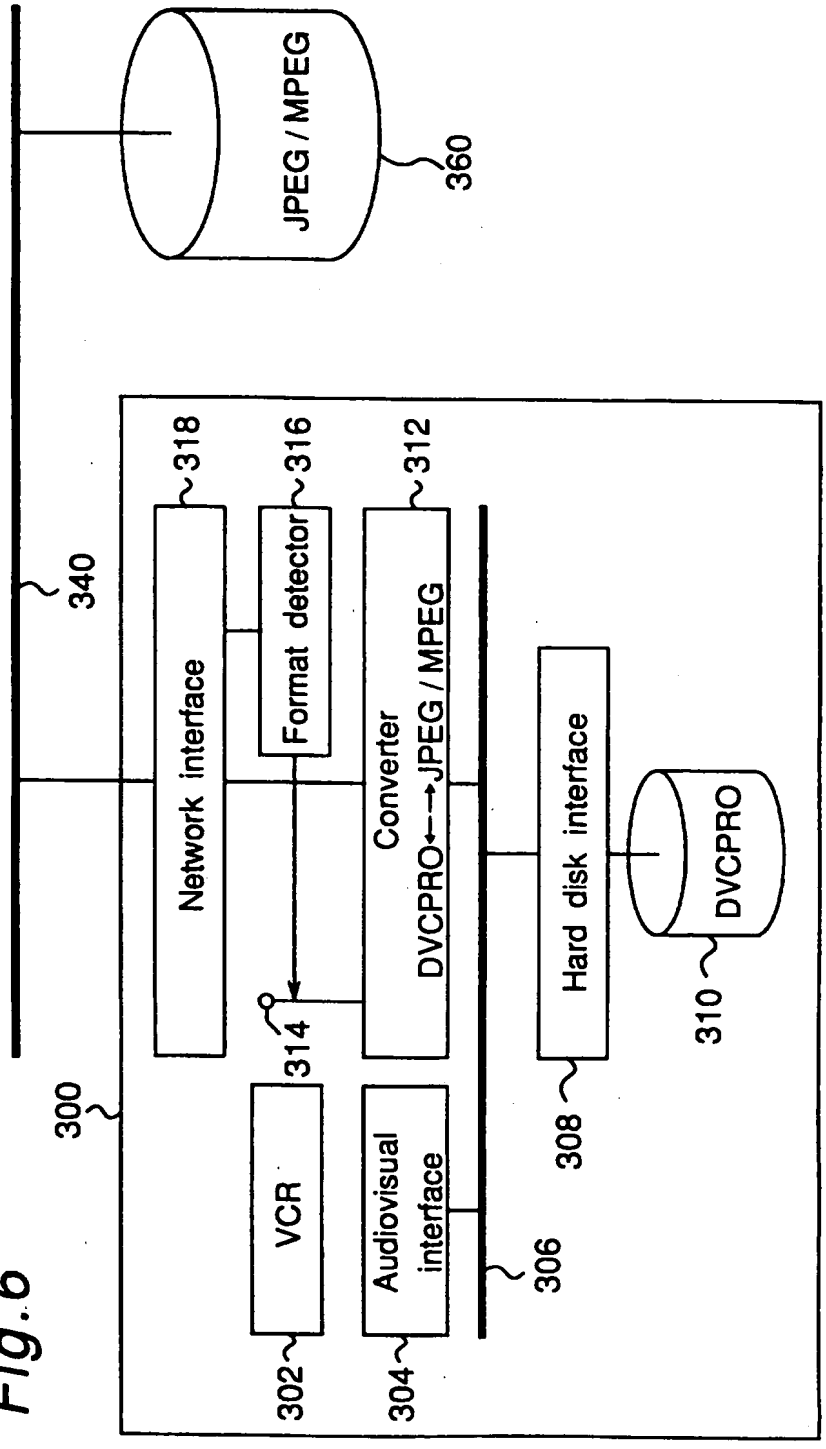

JPEG / MPEG
360
340
300
Network interface
318
Format detector
316
Converter
DVCPRO←→JPEG / MPEG
312
Hard disk interface
DVCPRO
310
308
VCR
302
Audiovisual interface
304
306
314

Fig.6

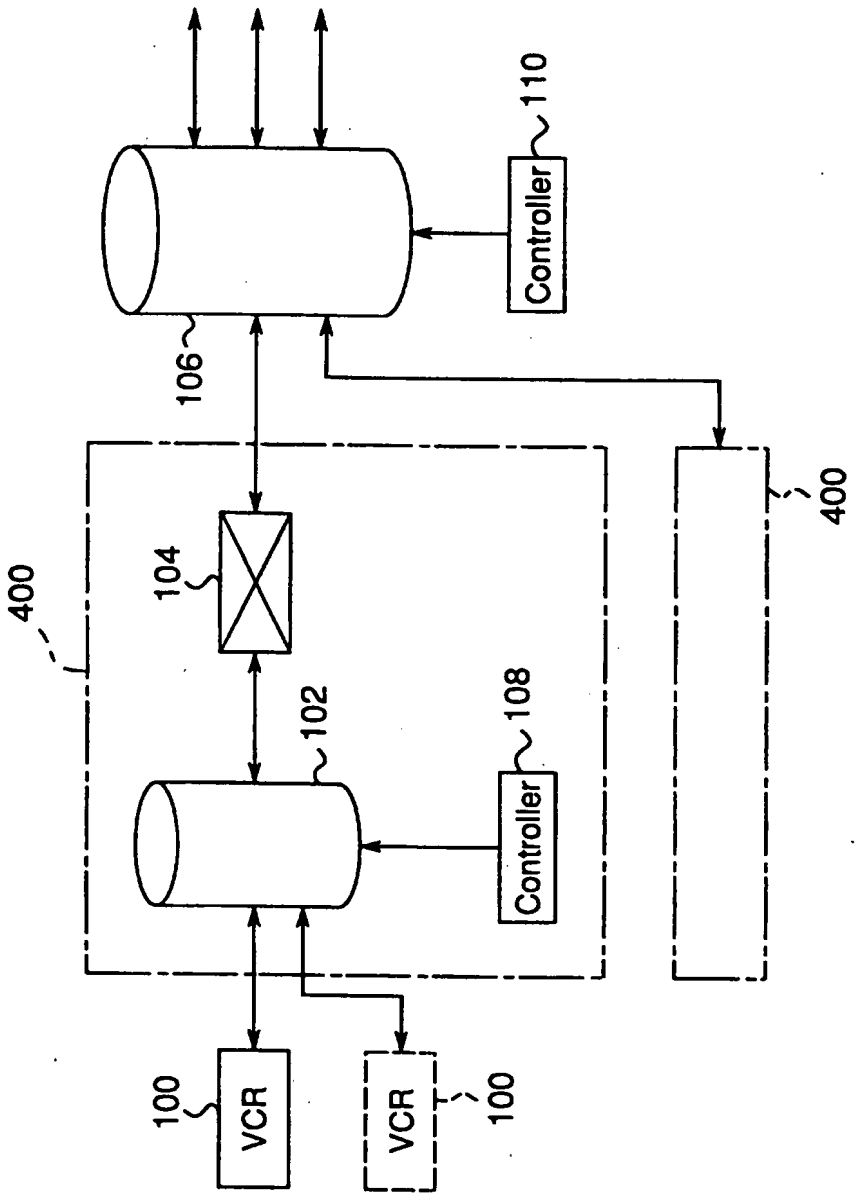
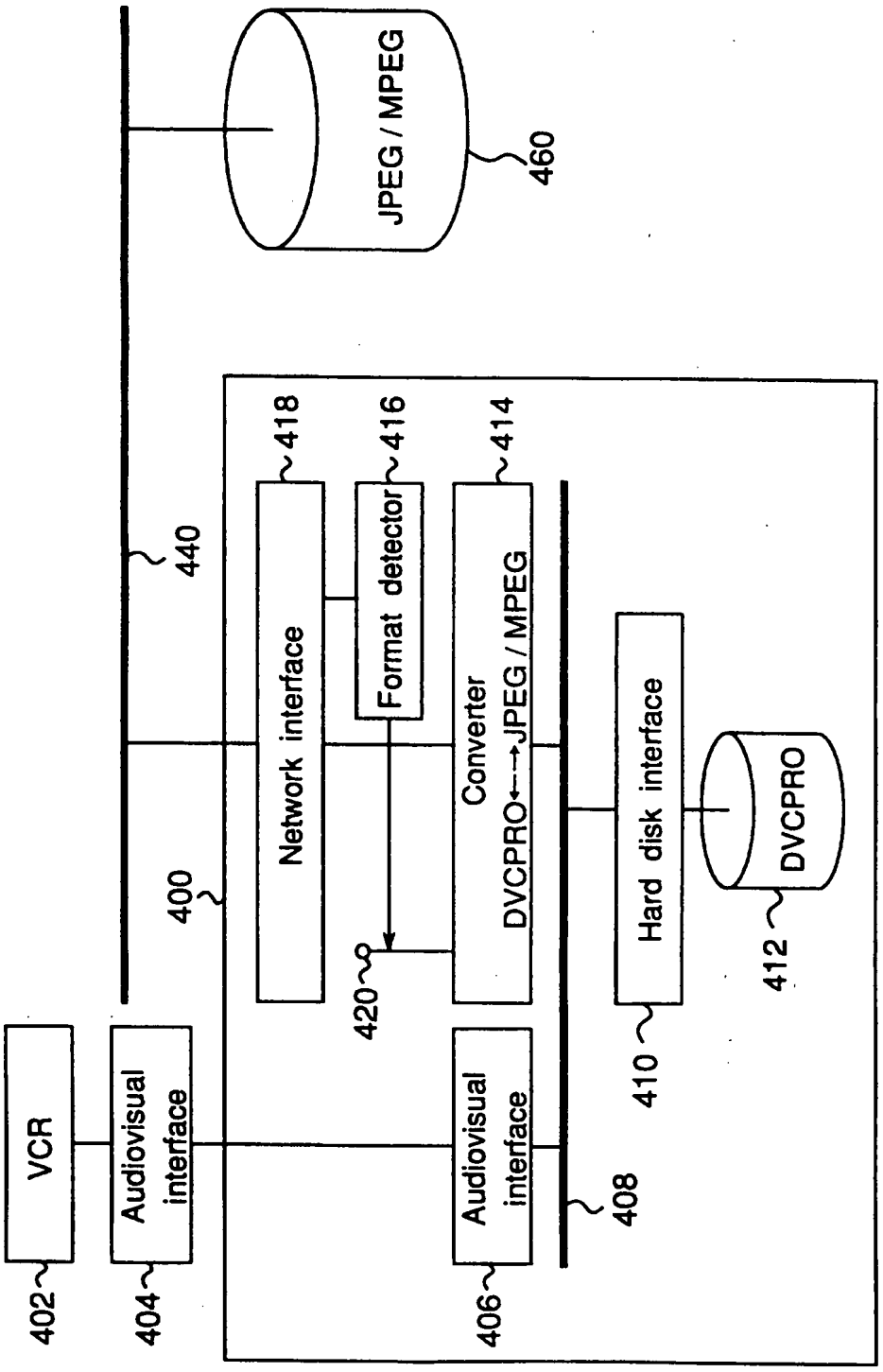

110
Controller
106
400
104
400
102
108
Controller
100
VCR
VCR
100

Fig. 7

Fig.8


JPEG / MPEG
460
440
418
416
414
Network interface
Format detector
Converter
DVCPRO←→JPEG / MPEG
Hard disk interface
DVCPRO
412
400
420
410
408
VCR
Audiovisual interface
Audiovisual interface
402
404
406

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/JP 96/02894

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04N7/26 H04N7/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,93 16557 (KOZ ET AL.) 19 August 1993 see the whole document ---	1-22
A	BETTER VIDEO IMAGES, 1989, SMPTE, pages 157-169, XP000088837 PANTUSO: "Reducing Financial Aliasing in HDTV Production" see the whole document ---	1-22
A	SMPTE JOURNAL, vol. 104, no. 9, September 1995, WHITE PLAINS, NY, US, pages 582-587, XP000523228 PROULX ET AL.: "Designing a Digital Facility: a Case Study" see the whole document --- -/--	1-22

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
13 January 1997	28.01.97
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Authorized officer Foglia, P

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INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/JP 96/02894

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	VISUAL COMMUNICATION AND IMAGE PROCESSING '91, vol. 1605, no. 2/2, 11 November 1991, BOSTON, MS, US, pages 886-893, XP000479295 BOVE ET AL.: "Cheops: a Modular Processor for Scalable Video Coding" see the whole document	1-22
A	SMPTE JOURNAL, vol. 102, no. 12, December 1993, WHITE PLAINS, NY, US, pages 1120-1124, XP000428934 REYNOLDS: "Design Considerations for Serial Digital Television Systems" see the whole document	1-22
A	18TH INT. TELEVISION SYMPOSIUM AND TECHNICAL EXHIBITION, 10 June 1993, MONTREUX, CH, pages 613-637, XP000385319 CLAUS ET AL.: "On Air Automation, Cart Machines and Live Presentations, how does that fit?" see paragraph 5	1-22
A	IBC '95, 14 September 1995, AMSTERDAM, NL, pages 488-493, XP000614019 OWEN: "DVCPRO: Playing to the strengths of Tape"	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ional Application No
PCT/JP 96/02894

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		AU-A-	3271993	03-09-93
		CA-A-	2128322	19-08-93
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JP-A-7143475	02-06-95	NONE		